ISS PAYLOADS NEWS

September 2004
Volume 2, Issue 4

Customer Service Hot Line: 281-244-6187

Human Research Facility Explores Human Capabilites in Space

By Cindy Haven

In response to President Bush's announcement of a new set of space initiatives for the nation this past January, NASA has reorganized to strategically align with the new exploration vision and reprioritized its science programs to focus on the mitigation of risks to humans on long-duration space flights. Administrator Sean O'Keefe added that "Space Station research necessary to support human exploration to other worlds will be complete by 2016."

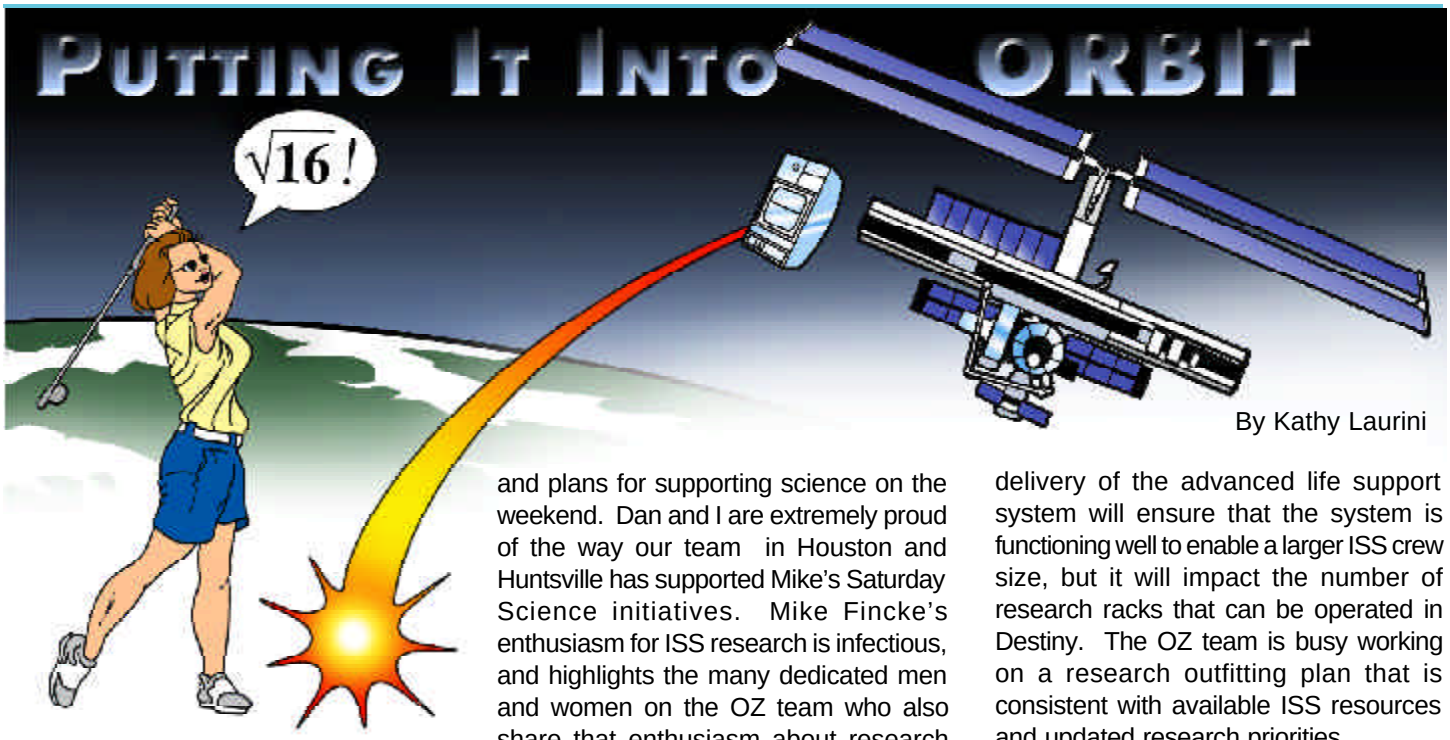
Here at JSC, these Agency-wide changes have pushed the work of the Bioastronautics Research Integration Office (BRIO) into the limelight. BRIO manages the flight research projects designed to study the physiological and behavioral changes induced by long-duration space flight, and it is these investigations that will provide the answers to propel the Agency beyond low Earth orbit.

Supporting investigators from all over the world, the BRIO team is poised to meet the challenges that lie ahead. The Human Research Facility (HRF) Rack 1, a complement of laboratory equipment designed to support these human space flight investigations, was introduced to the ISS in March of 2001. HRF Rack 1 and HRF Rack 2 (awaiting its launch opportunity on LF-1) provide structural, power, thermal, command and data handling, and communication and tracking interfaces between the HRF biomedical instrumentation and Destiny, the U.S. Laboratory Module. The HRF provides capabilities for ultrasound, metabolic gas analysis, body mass measurement, and refrigerated centrifugation. The HRF also provides a system of drawers and kits for stowing component accessories and experiment-unique hardware.

Examples of some of the numerous ongoing HRF experiments include "Foot/Ground Reactions Forces During Space Flight" (Foot) and "Advanced Diagnostic Ultrasound in Microgravity" (ADUM). The Foot team studies lower-extremity bone loss, a critical barrier to extended stays in space. At the start of each day, crewmembers don experiment hardware including a specially designed insole that is placed inside the shoe that measures the load on lower extremities, and a custom-fitted Lycra suit that monitors changes in joint angles. By quantifying both the load on lower extremities and crewmembers' muscle activity throughout the day, the Foot team hopes to lay the foundation for establishing countermeasures for bone and muscle loss. ADUM is an experiment that investigates the efficacy of ultrasound in microgravity for clinical applications. ADUM is looking at the feasibility of ultrasound to monitor in-flight bone alterations, and to determine the optimal training methodology for non-physician astronauts. It is hoped that ADUM will prove that crewmembers can accurately diagnose mission-critical medical conditions via remote medicine during flight.

By providing a better understanding of how the body adapts to space flight and the countermeasures to maintain the crew's mental and physical fitness, each of the over 40 BRIO investigations is designed to move NASA one step closer to its new exploration vision.

What's Inside



By Kathy Laurini

I was thrilled when Dan asked me to write "Putting it Into Orbit" this time. It has been a tremendous increment for research onboard the International Space Station (ISS). The Increment 9 crew, Commander Gennady Padalka and ISS Science Officer, Mike Fincke, have accomplished many exciting things during their stay onboard ISS. This is largely due to the enthusiasm of Mike Fincke. The increment has brought many challenges in maintaining ISS systems, yet Mike has found the time to accomplish most all of the planned science, plus some additional activities which were not planned at the time of his launch. Through a program we have called "Saturday Science", Mike has volunteered a significant amount of his off duty time to conducting research. He often performs these investigations on the weekend. Without the time constraints of normal workdays on the ISS, Mike is able to take extra time to optimize experiment set-up, such as camera positioning, and also to interact with Principle Investigators by Space-to-Ground link to make real time adjustments and maximize science return. These efforts on Mike's part have delivered interesting scientific results which you will read about in this newsletter.

Taking advantage of Mike's donated time has also required many on the OZ team to work hard to pull together procedures and plans for supporting science on the weekend. Dan and I are extremely proud of the way our team in Houston and Huntsville has supported Mike's Saturday Science initiatives. Mike Fincke's enthusiasm for ISS research is infectious, and highlights the many dedicated men and women on the OZ team who also share that enthusiasm about research onboard the ISS. Their efforts ensure that every detail is taken care of so that research plans can be implemented successfully.

> *"...we celebrate Mike Fincke's enthusiam..."*

Back on the ground, much activity has been focused on responding to the vision for exploration and the role that ISS research will play. NASA Headquarters has undergone an organizational transformation, while also reassessing research priorities consistent with exploration goals. The new Exploration Systems Mission Directorate is now responsible for developing the technologies and vehicles required for exploration missions, as well as managing the research necessary to enable those missions.

The ISS Program has been busy developing assembly and vehicle transportation plans consistent with the planned retirement of the Space Shuttle in 2010. On July 23, 2004, the Heads of Agencies participating in the ISS Program met in Noordwijk, The Netherlands, and endorsed a configuration for the ISS. This configuration includes all the planned International Partner elements, the Centrifuge Accomodation Module (CAM), Node 3 and the Cupola. It also calls for early delivery of the U.S. advanced life support system which will initially be located in the U.S. Lab, Destiny. Early delivery of the advanced life support system will ensure that the system is functioning well to enable a larger ISS crew size, but it will impact the number of research racks that can be operated in Destiny. The OZ team is busy working on a research outfitting plan that is consistent with available ISS resources and updated research priorities.

The last increment before Shuttle return to flight, Increment 10, will launch in a few weeks, and we will continue to maintain a strong research program despite the constraints of limited Progress upmass. As return to flight nears, we are focused on preparing and integrating a large complement of research racks and resupply items for delivery to the ISS on LF1 and ULF1.1. Work is also underway integrating payloads for subsequent flights. All in all, there is a lot to be excited about and we celebrate Mike Fincke's enthusiasm because that is how we all feel.

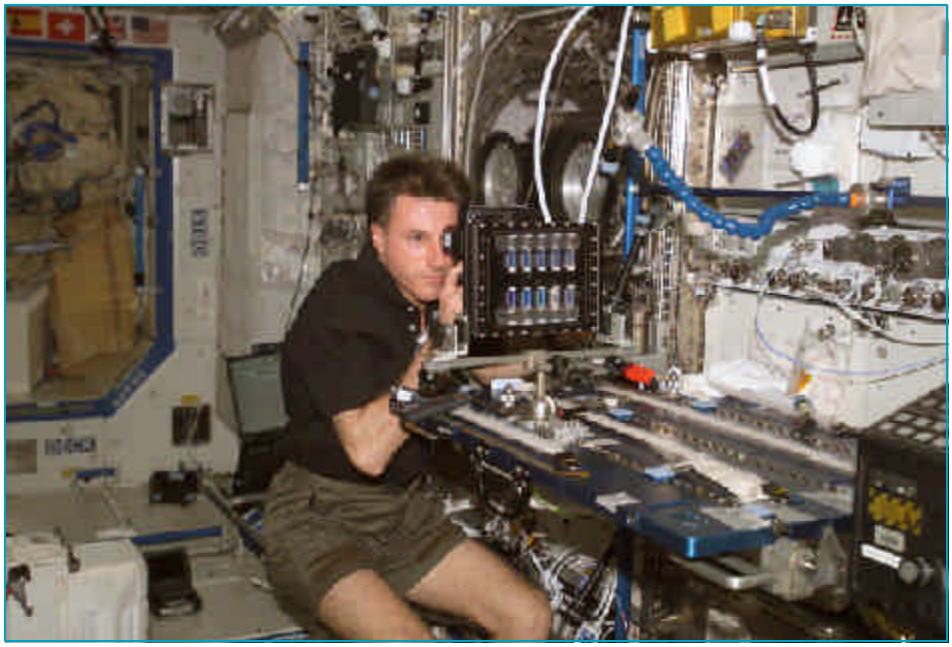
Mike Fincke . . . ISS Utilization Hero

ISS Research is Serious, Exciting and Fun

By Peter Lu with Mick Culp

Peter Lu is a graduate student in the Harvard Physics Department. His advisor, Professor David Weitz, offered him the opportunity to develop a research project to be performed on the International Space Station. The project was to study the long-term behavior of colloids in a microgravity environment; i.e., monitoring the separation structure and velocity as the colloids come out of the solution without the impediment of sedimentation caused by gravity on Earth.

While at JSC to train the crew for Increment 10, Peter had some free time during which he gave a very inspiring review of his experiment to the Space Station Program Control Board. That talk prompted me to request an interview with Peter and the following resulted.



Mike Foale prepares early photography of BCAT-3 samples.

ISS PN: *Talk about the preflight preparation of your experiment.*

Peter: Dr. Weitz came to me and said, "We have this new, small experiment with NASA to understand the critical point behavior, so figure out what you need to do and make the samples." So I made samples and tested them. That was the very beginning.

Then I went to Glenn Research Center in Cleveland where I developed the photographic protocol with the Glenn folks. We were told we had a camera, samples and a flashlight. How do we turn that into a procedure they could use on orbit to get our data? We laid that out and the Glenn folks worked the details. Then I came to JSC the end of August of last year to train Mike Foale (Increment 8 astronaut). And that was a lot of fun.

Did you feel you had sufficient time to train the crew?

Oh yes. Before anything went up, you know, it's hard to know exactly what kind of problems you're going to run into. This is completely different from the previous BCAT experiments that flew like seven or eight years ago. They had a film camera and would send film back to process. We get photos down the next day. We can communicate with the crew almost immediately, saying this is right, this is better… we get feedback from them. So the procedure developed in Cleveland last summer is still in development. With the photos from Mike Fincke, he sends down "maybe we should try this in the procedure or you might want to explore …" and it's this constant dynamic process that we're going through.

It sounds like you get plenty of interaction with the crew on board.

Oh, tremendous amounts. So fast forward. In January, the thing launches on 13P. We're told our experiment will run in June; but in March, Foale did the first run of our data. Before he started he called down, which is very exciting. I was home and got to talk with somebody on the Space Station and he took a few days of data, we sent him some more photos and he wanted to talk again, so he called down again. To me it was actually cool, because he called me at home. It was 4am, and here I am at home talking to somebody on the Space Station; very exciting. So, that was pretty neat. We went back and forth and he took a bunch of photos and he worked on them with Mike Fincke during the time they were up there together.

Then Foale comes back and Fincke is taking the photos. He did all the planned stuff and then there were some problems, so he did it again. He has this Saturday Science program where he volunteers his time to research. He's been really very, very generous.

It was really interesting. I was always under the impression that you get a NASA physicist, big science experiments and it's all very complicated, all automated and you test and test it, add the bells and whistles, it works and they deliver results. Our experiment is kind of the antithesis of that. We sent up three kilograms, 10 samples, and basically it lives or dies on whether the astronauts take the pictures correctly. So far they've really exceeded what I even thought was possible. On the ground, we had plenty of time and all the brackets and we lined it up and took pictures. Yet, the stuff we're getting from space…they're doing better than we did. And that's just amazing!

With these samples, can you start over?

Absolutely, and that's the next thing. This time we took photographs of all samples at scheduled times to make sure we didn't miss whether separation ultimately took place. We scheduled an hour, a day, a week, a month and two months. But it turned out there's a lot of activity going on within the first couple of days, so when we restart the experiment we're going to be focusing our efforts there. We never anticipated we'd be able to detect structures in that first couple of days, but it turns out the photos are very good; and if the photos

(see **LU** page 12)

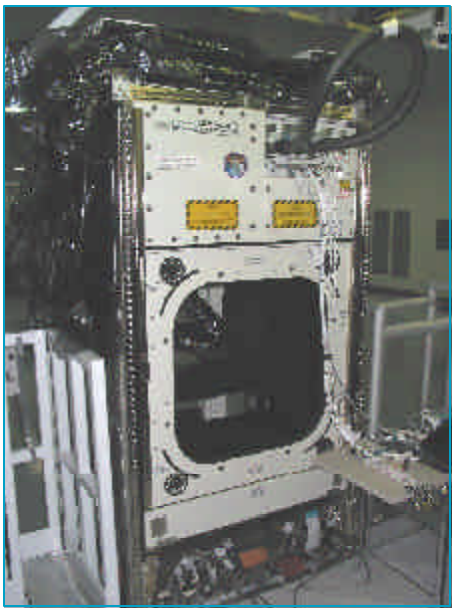
KSC Prepares for Return to Flight

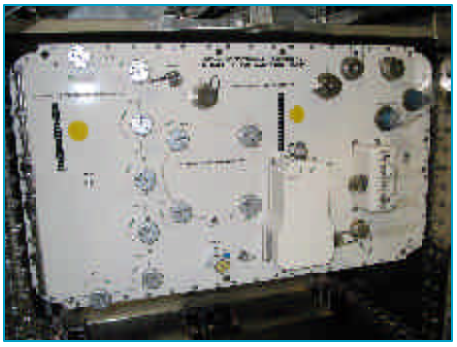
By Ronnie Rodriguez

Greetings from the KSC Utilization Project Office! With Return To Flight (RTF) just a few months away, things are starting to pick up at KSC. With two Multi-Purpose Logistics Module (MPLM) missions back-to-back and lots of unmanifested hardware needing care and feeding, the KSC testing schedule is pretty full. Throw in monthly Integrated Thermal Control System samples on EXPRESS Racks, WORF and MELFI, and the schedule looks like it just might burst. In addition to all of this, we are expecting delivery of the Habitat Holding Racks (HHRs) and the Fluids and Combustion Facility (FCF) soon. Here's the plan – get to work and don't stop for months. "Angels and ministers of grace defend us!" Ok, maybe that is a little dramatic; but if it worked for Shakespeare…

So what's going on, you ask? Let's start with Risk Mitigation. Since we (the Program – OneNASA, remember?) decided that we would like to make sure an active MPLM actually works, we dreamed up a Risk Mitigation Test to check it out. That is going to include the MELFI Flight Unit #1. We plan to prep it and turn it over to the MPLM to make sure we can communicate with a rack in the MPLM. Who's going to talk to it? Why MSFC, of course. If all goes well, we will verify that the Payload Operations Control Center (POCC) at MSFC will be able to communicate with a rack in an MPLM that is still in the Orbiter payload bay. Speaking of MELFI, Flight Unit #2 arrived in July. It needs a three-week post-delivery checkout in our Payload Rack Checkout Unit (PRCU) and a one-week acoustic test.

Clockwise from above: MELFI, SpaceDRUMS quad locker, EXPRESS rack, HRF-2 and WORF in ground processing at KSC.

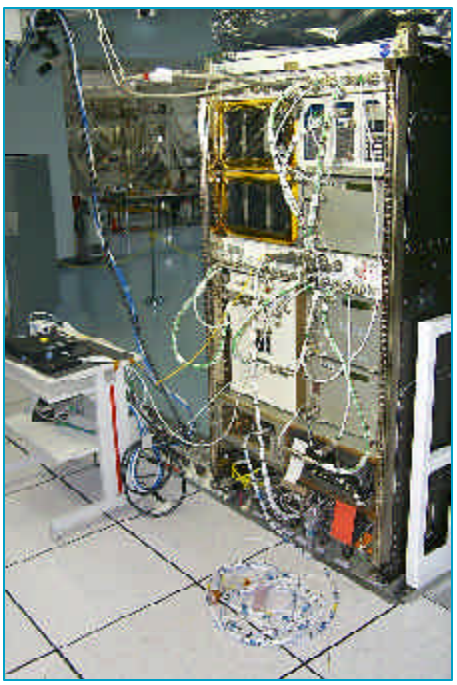




We are looking at delivery of Habitat Holding Racks #1 and #2 in August and September, respectively. Each gets a few days of post-delivery checkout in teh PRCU as well. September should also see the delivery of both Active Common Attach System Simulator (ACASS) units. They will be checked out in the PRCU and the Payload Test and Checkout System (PTCS). Their job is to provide an interface between our checkout systems and attached payloads.

Now let's get to some RTF stuff. LF-1 will carry HRF-2. We have a few weeks of PRCU work, closeouts and installation into TMNT Raffaello. Kawabunga, Dude! (Those of you with kids are probably aware of the unfortunate return of the Teenage Mutant Ninja Turtles (TMNT)). Throw in some middeck processing and testing, and we are finally processing for flight again with a launch projected for March 6.

(see **KSC** page 5)



Need ISS Information? . . . . . Try the PD Web Portal

By Thomas W. Griswold

The ISS Payload Developer's Portal is a collection of Web pages meant to help Payload Developers (PDs) and Principle Investigators (PIs) through the integration and operations processes by providing instructions, reference materials, schedules and links to other sources where assistance may be obtained.

The top-level pages are open to the public and contain general information and links. On-line forms are available where users can submit questions or ask for help.

More detailed information related to a specific payload/experiment can be viewed by logging into the password-protected area. The PD Portal shares security with the Payload Data Library (PDL), so the same User ID and password can be used in both places. Once logged in, the user will find information such as points of contact (complete with phone numbers and e-mail addresses), schedule data, status information and convenient links.

The schedule data are imported directly from the PIM Schedules weekly, and milestones are connected via hyperlinks to descriptions and related materials. The schedule page, sortable by date or technical discipline, can be thought of as a roadmap through the integration process.

The recent addition of the Payload Questionnaire provides an on-line means of submitting data that is required to build the Payload Tactical Plan (PTP) and Mission Integration Plan (MIP). Context-sensitive help assists the users in making sure the correct information is filled in. Having the data stored in a database, rather than embedded in a document, facilitates the automation of tasks that were manual and labor intensive in the past. For instance, a Manifest Modeler tool is in work that allows a quick "what if" analysis for selecting a complement of payloads for a flight.

The PD Portal can be accessed at http://stationpayloads.jsc.nasa.gov/pd/. To obtain a PDL account to gain access to the password-protected areas, go to http://pdl.hosc.msfc.nasa.gov/web_html/pdl_requests.html.

ATTENTION: EXPRESS Users' Teleconference

By Nancy Hallmark

The EXPRESS Rack Users' Telecon is held biweekly on Wednesdays at 8:30 a.m. Central Time. This forum provides an opportunity for open communication on all topics related to EXPRESS integration. Current ISS Program information is discussed, along with updates to schedules, requirements and integration processes. Payload Developers are also encouraged to bring up issues and concerns that may affect the EXPRESS payload community. Mike Danford, EXPRESS Integration Project Manager, sponsors this forum, and regular participants/topics include updates from the Program Office, Payload Integration Managers, KSC Physical Integration, Safety, Payload Mission Integration and Planning, Payload Engineering Integration personnel, and any other Special Topics as needed/requested.

If you are an EXPRESS Payload Developer and are not already involved with the Users' Telecon, please contact Matt Appleby (matthew.h.appleby@boeing.com) to be added to the meeting announcement distribution list. Other tie-in information: Telecon # 888-790-9405, Passcode: EXPRESS. The agenda is posted to the ISS Payloads Weekly Meetings calendar (http://isswww.jsc.nasa.gov/ss/issapt/payofc/OZ2/regular.html).

KSC

(continued from page 4)

Since we already started talking flight, let's get to ULF-1.1 and TMNT Leonardo. We need to run MELFI, EMCS and SpaceDRUMS through the PTCS (EMCS – European Modular Cultivation System; SpaceDRUMS – Space Dynamically Responding Ultrasonic Matrix System). Then we'll get each closed out and installed in Leonardo. Let's not forget our middeck operations. All of this will be done in hopes of launching on May 5.

The Alpha Magnetic Spectrometer–2 (AMS-2) has also requested a Functional Integration Test (FIT) in which they plan to checkout their electronics to make sure their design is compatible with Shuttle and Station. That's planned for early next year and will be the first use of the ACASS to support a test.

Just to wrap things up, we will be receiving the Combustion Integration Rack (CIR), as well as Analysing Interferometer for Ambient Air (ANITA) and Anomalous Long Term Effects on Astronauts (ALTEA). Then we'll check out CIR through the PRCU and ALTEA and ANITA through the PTCS.

All this will happen between August and February. Maybe the "angels and ministers" won't be enough. Well, at least we haven't had a hurricane yet this year. That wouldn't fit in the schedule. (I hope I didn't jinx us.)

Ed: Since receiving this article, Florida has been hit by three hurricanes with more on the way.

Expeditio

By John Uri

Expedition 8 Science Officer Mike Foale and ESA Astronaut Andre Kuipers working on the HEAT experiment in the Microgravity Sciences Glovebox.

The Expedition 8 crew of ISS Commander and NASA Science Office Mike Foale and Russian Flight Engineer Alexander Kaleri wrapped up a very successful six-month mission in late April, conducting a number of U.S., Russian, Japanese and European experiments while also maintaining the vehicle's systems. They completed 25 U.S. investigations, including six that were new to the ISS Program, dedicating 259 hours of on-orbit crew time to the effort. Several of the new investigations had arrived aboard the 13Progress (13P) vehicle in January. In March-April, the Microgravity Science Glovebox (MSG) was operated continuously for 31 days to support a European Space Agency (ESA) crystallization experiment (PromISS).

Foale and Kaleri turned ISS over to the Expedition 9 crew of Commander Gennady Padalka and Flight Engineer and NASA Science Officer Mike Fincke. During the nine-day handover period in April, ESA astronaut Andre Kuipers of The Netherlands conducted 20 investigations as part of the DELTA Science Mission, including two using the MSG, ARGES and HEAT (see photo above).

Now nearing the completion of their six-month mission, the Expedition 9 crew has been very busy with research, as well as with conducting significant systems tasks. Their original mission plan called for two Extravehicular Activities (EVAs) or spacewalks, but a third was added to replace a failed power controller supplying power to one of the Station's Control Moment Gyroscopes (CMGs), part of the attitude control system. This complex EVA required the crew, wearing Russian Orlan suits and exiting out of the Russian Pirs airlock, to translate to the Z1 truss of the U.S. segment. When the EVA was first tried on June 24, one of the suits failed, canceling the EVA after 14 minutes. The crew tried again five days later, and this time the EVA was highly successful, bringing the CMG back to full functionality. On August 3, Padalka and Fincke stepped out again, this time completing one of the planned EVAs to install new laser retroreflectors to the aft end of the Zvezda Service Module, in preparation for the docking of the first ESA Automated Transfer Vehicle (ATV) planned for late in 2005. During this EVA, the crew also retrieved and replaced several panels for the Russian Kromka, Platan and SKK materials exposure experiments. During the fourth and final EVA on September 3, Padalka and Fincke continued to prepare the Service Module for the ATV's arrival. The crew also spent time working with visiting Progress vehicles, overseeing the loading and departure of 13P on May 24, the arrival of 14P three days later, the loading and departure of 14P on July

Mike Foale working behind BCAT sample carrier.

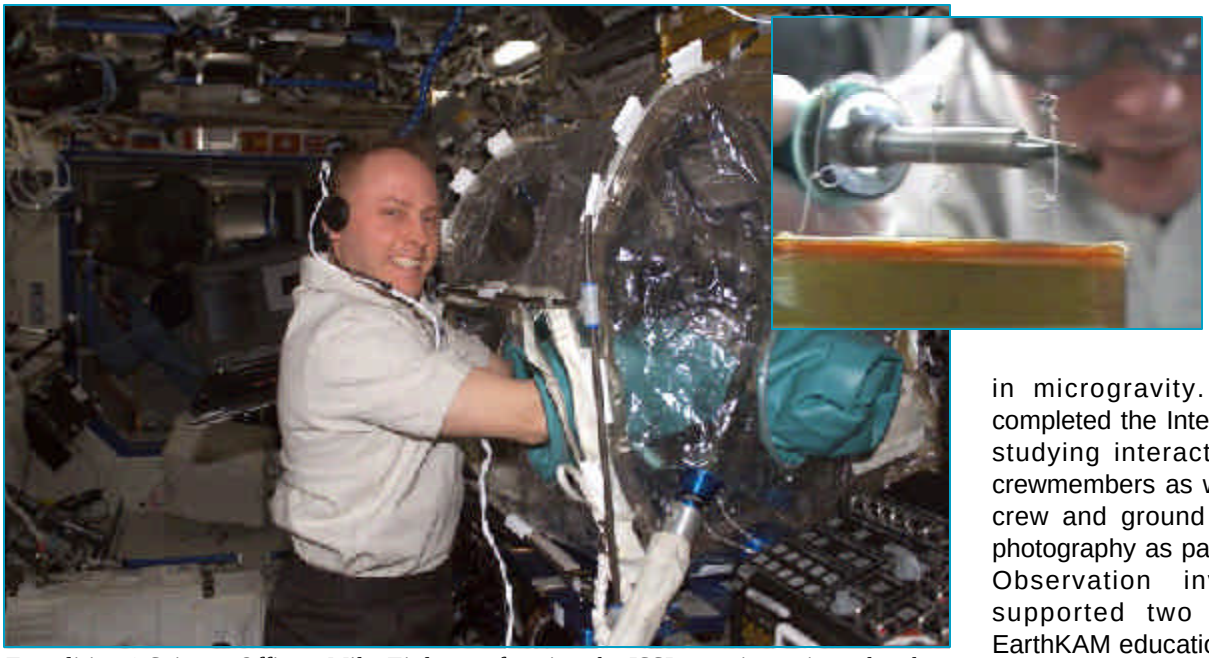
9 Research

30 and the arrival of 15P August 13. Unfortunately, we have not been successful in placing any U.S. payloads on either 14P or 15P, further straining our capability to continue the onboard research program, which is now more reliant on hardware already on board.

Eighteen US experiments were planned for Expedition 9, with several already completed and the others well under way. Four new investigations are being performed during this mission. The Fluid Merging Viscosity Measurement (FMVM) experiment, launched on 13P in January, is verifying a new method of measuring viscosity by observing how two drops of liquids of different viscosity merge. Results have implications on the production of glass in space and the casting industry here on Earth. The Viscous Liquid Foam – Bulk Metallic Glass (FOAM) experiment, also delivered on 13P and completed in late July, studies the formation of foam from metallic glass to help develop high-strength/low-weight materials, with implications for future spacecraft building. The Serial Network Flow Monitor (SNFM) experiment, consisting of software loaded on an EXPRESS Rack laptop, monitors local area network and captures packet statistics to help validate data link models. The In Space Soldering Investigation (ISSI) is an experiment designed to use only equipment already on board ISS, reducing reliance on limited upmass. It studies the effects of weightlessness on the soldering process (see below). It was completed as part of a program called Saturday Science, during which Mike Fincke volunteers his off-duty time to conduct additional research. Other activities conducted as part of Saturday Science have included conferences between Mike and various investigators on the ground.

Leroy Chiao and Salizhan Sharipov crew of Expedition 10.

Fincke and Padalka are also conducting investigations that were begun during earlier expeditions. In the Advanced Ultrasound in Microgravity (ADUM) investigation, the crew conducted ultrasound exams on each other to help develop strategies for diagnostic telemedicine both in space and on Earth. In the Journals investigation, Fincke's onboard journal entries are studied to help design equipment and procedures to allow astronauts to best cope with long-duration space flight. The Binary Colloidal Alloy Test-3 (BCAT-3) experiment, begun by Mike Foale during Expedition 8, continued successfully to study the phase separation of colloid materials. The Miscible Fluids in Microgravity (MFMG) investigation uses honey and water to determine if miscible fluids exhibit the same transient phenomena as immiscible fluids in microgravity. The crew also completed the Interactions experiment studying interactions between the crewmembers as well as between the crew and ground control, continued photography as part of the Crew Earth Observation investigation, and supported two sessions of the EarthKAM education payload.



Expedition 9 Science Officer, Mike Finke, performing the ISSI experiment in a glovebox. Insert shows closeup of the soldering iron and test subject.

(see **RESEARCH** page 8)

Research

(continued from Page 7)

After their return to Earth, Padalka and Fincke will continue their participation in the research program by conducting postflight sessions of several investigations to monitor their recovery to 1-g conditions. Among these are Interactions that had in-flight sessions, as well as the Mobility experiment that studies changes in postural control; Biopsy that studies changes in muscle mass, tone and strength; and Chromosome that examines the effects of ionizing radiation on chromosomes.

Expedition 10 is scheduled to get under way on October 9, 2004, with the launch of the 9Soyuz (9S) spacecraft from Baikonur, Kazakhstan. The crew, ISS Commander and NASA Science Officer Leroy Chiao and Russian Flight Engineer Salizhan Sharipov, will conduct up to 17 U.S. investigations during their six-month stay. Some U.S. research hardware may be launched on 16P and 17P during Expedition 10. Negotiations are still under way. Near the end of their mission, based on current plans, the Space Shuttle will return to flight with the STS-114/LF-1 mission. This flight, principally a test flight to validate several Shuttle return to flight activities and to resupply the station, will also carry the Human Research Facility-2 (HRF-2) rack (right), to complement the onboard HRF-1 rack. The HRF-2 rack contains a Refrigerated Centrifuge, an accurate body mass measurement device, a pulmonary function measurement system provided by ESA, and upgraded computers for both racks. This additional rack will provide an enhanced capability to conduct human physiology investigations critical for enabling exploration missions. In addition, the MISSE PEC-5 external payload will be launched and placed on the exterior of the Station, and the MISSE PECs 1 and 2, in orbit since August 2001, will be returned to the ground for analysis of the hundreds of samples that have been exposed to the space environment.

Looking beyond Expedition 10, the second Shuttle flight, STS-121/ULF1.1, will continue the outfitting of ISS with additional research racks. The Minus-Eighty degree Laboratory Freezer for ISS (MELFI) will provide researchers with the ability to store samples at -80°C, -20°C, and +4°C, greatly expanding the research capability of the Station. The ESA-provided European Module Cultivation System (EMCS), to be placed in an onboard EXPRESS Rack, will support a variety of plant and cell biology experiments. The Space Dynamically Responding Ultrasonic Matrix System (SpaceDRUMS) facility will occupy another EXPRESS Rack and provide the capability for containerless processing of a variety of ceramics and other samples.

The Human Research Facility-2 installed in an MPLM for launch on LF-1.

Table – Expedition 10 Investigations

Acronym	Investigation Title	Principal Investigator
ADUM	Advanced Diagnostic Ultrasound in Microgravity	Scott Dulchavsky
Biopsy	Effect of Prolonged Spaceflight on Human Skeletal Muscle	Robert Fitts
Chromosome	Chromosomal Aberrations in Blood Lymphocytes	Gunther Obe
Journals	Behavioral Issues Associated with Isolation and Confinement: Review and Analysis of Astronaut Journals	Jack Stuster
Mobility	Mitigate Locomotor Dysfunction After Long-Duration Space Flight	Jacob Bloomberg
CEO	Crew Earth Observations	Kamlesh Lulla
EarthKAM	Earth Knowledge Acquired by Middle School Students	Sally Ride
EPO	Education Payload Operations	Cynthia McArthur
MISSE	Materials on ISS Experiment	William Kinard
SNFM	Serial Network Flow Monitor	Carl Konkel
BCAT-3	Binary Colloidal Alloy Test-3	Dave Weitz
CBOSS-FDI	Cellular Biotechnology Operations Support System-Fluid Dynamics Investigation	Joshua Zimmerberg
CFE	Capillary Flow Experiment	Mark Weislogel
DAFT	Dust Aerosol measurement Feasibility Test	David Urban
MAMS	Microgravity Acceleration Measurement System	Richard DeLombard
SAMS	Space Acceleration Measurement System	Richard DeLombard
PCG-STES	Protein Crystal Growth-Single locker Thermal Enclosure System	Dan Carter

Payload Operations and Integration

Increment 9

By Lamar Stacy

In the final months of pre-Increment preparation, the manifests for the 14Progress (14P) and 15P flights still included payload hardware. An Operations Technical Interchange Meeting (Ops TIM) was conducted on 6-7 April with most of these Payload Developer (PD) teams. The participants included DAFT, EarthKam, SPHERES, PASC and CGBA Service Kit. Although these payloads were later deleted from the Progress manifests, the meetings were productive for MSFC personnel supporting future Increments.

The primary focus during the final pre-Increment weeks was the toxicity issues with the European Space Agency (ESA) payloads ARGES and Heat. These experiments would be operated during the 8Soyuz (8S) docked period by the ESA Astronaut Andre Kuipers. Although the payloads were classified as a Toxic Level 0 by the Payload Safety Review Panel, personnel at MCC-H determined that ARGES should be treated as a Toxic Level 4 due to its mercury content. The Heat payload was also treated as a Toxic Level 4 due to ammonia. Additional Flight Rules and emergency response procedures were developed and approved that allowed the payloads to be operated.

The Heat payload was installed in the Microgravity Science Glovebox (MSG) during Increment 8 by Mike Foale. Andre initiated the payload operations when he arrived on 8S. All six runs terminated earlier than anticipated due to lack of sufficient thermal transfer to the MSG coldplate. ESA and MSG have developed an alternate procedure and facility configuration to address the problem. We currently seek an opportunity to schedule a second session.

On 24 April, the ARGES payload was installed in the MSG. Andre successfully completed processing of lamps 1-10 in automated mode for emission spectroscopy and lamps 11-20 in manual mode to observe for helical instabilities. The payload was a complete success, and early reports from ESA indicate good science results.

During joint operations, Mike Foale and Mike Fincke completed another photography session of the Binary Colloidal Alloy Test-3 (BCAT-3) payload. This experiment was initiated in March to study the behavior of colloids in a microgravity environment. The final planned photography session was performed by Mike Fincke in May. Several follow-on sessions have been performed as Saturday Science to further investigate the early crystallization of long-duration samples.

The Crew Earth Observation (CEO) investigation has collected an incredible number of photos during the first four months. Mike has provided a log with descriptions and time tags of each CEO photo sessions to the PI. Per Mike's request, the PI is providing daily feedback and critique of his photography. As of 12 August, CEO had accumulated 11,000 photos during Increment 9.

Neurocog is an ESA payload that requires Gennady Padalka to perform psychophysical tasks with simultaneous recording of EEG activity. Mike provides assistance during each of the two-day sets of data collection. The first two sets have been completed. The third and final set will occur during the last weeks prior to crew departure.

The Advanced Diagnostic Ultrasound in Microgravity (ADUM) investigation has been operated as scheduled, including the monthly bone scans, two abdominal scans and the first thoracic scan. Remaining activities include two more bone scans and the final thoracic scan. This payload demonstrates the capability for a nonexpert sonographer to perform successful ultrasound evaluations in a remote location with real-time support via voice and video link. These scans have been deemed a 'great success' by the HRF science team.

All activities required to certify the MSG for continued operations were completed. MSG was activated without thermal flow to validate the thermal sensors within specification. Other activities included the annual cleaning and inspection of the MSG and replacement of the door seal and the battery in the video drawer.

EarthKam has completed both planned sessions. The first was 11-15 May with equipment setup in the Russian segment. A record number of 110 Middle Schools registered to participate. During the four days of operation, 1139 photographs were processed and delivered to 61 schools. The final session was conducted from 12-17 July. The hardware was set up in the Node for the first time since Increment 3. The primary objective of this session was to train educators for new participating schools.

Saturday Science has been utilized to complete numerous payload activities that could not be scheduled. This concept was discussed with Mike pre-Increment and finalized during the early weeks. This implementation differs from Increment 6 where Don Pettit created science. Mike selects from a list of programmatic science options. Payload activities completed via Saturday Science include BCAT photography, ISSI, Foam, MFMG, HRF software load, several payload OBTs and all of the PI/crew conferences. This concept is unique to this crew and does not imply a new process or obligation on subsequent increments.

Mike has completed soldering two of the five coupon sets for the In-Space Soldering Investigation (ISSI) as part of the Saturday Science program. This payload has produced some interesting results in the reactions of molten metal in microgravity. Mike converted critical segments of the video imagery to digital files and down-linked them for ground analysis. The science team found this format to be much more useful for analysis than the regular analog video. However, these files are very large (~3.45 Mgb/second of video) and present challenges to MCC-H for downlink due to the size of the files and Ku coverage.

Mike has completed three Educational Program Office (EPO) demonstrations; First Aid, Pollution and Tomatosphere photography. The Chicken Shake demo is planned for mid-August with assistance by Gennady to operate the camera.

The Space Acceleration Measurement System (SAMS) payload has been off-line since 6 May due to a software problem. Revised code has been

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Operations

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uplinked, and efforts continue to recover the system. Data from the Microgravity Acceleration Measurement System (MAMS) was used to evaluate a disturbance reported by the crew on 29 June. Using the MAMS data and information from the Russian Space Agency, it was determined that the disturbance was a thruster firing anomaly in the Russian segment during a planned maneuver and that it posed no risk to the upcoming EVA. During the SAMS down-time, MAMS has operated in HiRap mode to capture more data.

The Serial Network Flow Monitoring (SNFM) experiment successfully captured network traffic for LANs 0 and 1.

Four of the eight sample syringes for the Fluid Merging Viscosity Measurement (FMVM) payload have been processed. The two syringes for glycerin would not adhere to the thread and could not be used. The two syringes of honey were at various stages of crystallization and can not be used until the crystals are dissolved. The PD team is currently investigating the use of the crew's food warmer to dissolve the honey crystals.

The Foam payload has processed all three samples and is stowed for future down manifest.

During Increment 8, the crew prepared syringes of honey and honey/water to conduct the isothermal and thermal studies for the Miscible Fluids in Microgravity (MFMG) payload. These samples were inspected by Mike for crystallization and found to still be viable. Subsequently, the first of the four thermal tests for MFMG was scheduled and completed using the CGBA to provide a gradient heat source.

During the first four months, the crew has completed numerous Task List activities including POSSUM photos, PERS inspection and other payload activities. Mike has conducted conferences with many of the payload science teams. These include ADUM, BCAT, CEO, EarthKam, FMVM, Foam, Interactions, Journals and SNFM. Several members of the EarthKam support team at the University of California San Diego participated with questions and feedback from various Middle School students.

During the first Russian EVA, a load shed was invoked on ISS to reduce the total power consumption. Both of the active payload racks, EXPRESS Racks 1 and 4, were deactivated along with the High-rate Communications Outage Recorder (HCOR). The Protein Crystal Growth payload in EXPRESS Rack 4 was without power for about five hours, but the thermally insulated container was able to maintain the sample environment within tolerances.

Four of the five EXPRESS Racks have been upgraded to Release 4 operating software. EXPRESS Rack 2 upgrade is pending completion of successful ARIS checkout in EXPRESS Rack 3 on this release. One feature of this upgrade is the capability to perform computer reboots via ground commanding vice using crew time. The HRF rack has been upgraded to Release 3.

Due to the number of high-priority activities added during the 15P Stage, crew time for payload operations during the remainder of Increment 9 will be limited.

Increment 10

By Tim Horvath

We're on-deck and warming up for what we hope is a successful Expedition! Our Increment begins with the 9S docking on October 11, 2004, and ends with the 10S docking in April 2005. Our crewmembers, Commander Leroy Chiao and Flight Engineer Salizhan Sharipov, have completed all of their payload training in Houston; so the next time we work with them, they'll be on orbit. Our payload operations products and certifications are nearly complete, with the Final On-orbit Operations Summary (OOS) publication planned for September 17.

Our remaining challenges for Increment 10 are crew time and flight manifest. The latter part of Increment 10 is full of joint operations and assembly tasks, with 17P, Russian Segment EVA #13, LF-1 docked operations, ULF1.1 packing activities, and 10S docked operations all planned from February to April 2005. At present, we cannot accommodate all required payload activities during these busy months. Also, several of our Increment 10 payloads need hardware launched to support their planned operations. They are currently manifested or are manifest candidates on 9S and 16P, so we are optimistic that the required hardware will fly.

As always, the Increment 10 team is working diligently to make operations as smooth as possible. If you have any questions or problems on Increment 10, please feel free to contact the Increment Lead POD at 256-544-3738 or tim.horvath@nasa.gov

Increment 11

By Pat Patterson

As a result of President Bush's announcement of The Vision for Space Exploration, the ULF1.1 manifest has been rebaselined. STS-121 will bring three new payload facilities to ISS: the Minus Eighty degree Laboratory Freezer for ISS (MELFI), the European Modular Cultivation System (EMCS) and the Space Dynamically Responding Ultrasonic Matrix System (DRUMS).

The MELFI will serve as a cooling and low-temperature storage facility used to preserve experiment specimens, samples and supplies until they can be used on orbit or returned to the ground to be analyzed. MELFI has requirements for three temperatures: +4°C (refrigeration), -26°C (freezing) and -80°C (preservation of biochemistry).

The EMCS is an ESA gravitational biology payload that will be operated during a two-year period on board ISS as an EXPRESS Rack insert. EMCS is dedicated to experiments on plants, especially multi-generation (seed-to-seed) experiments and the study of gravity effects on early development and growth. Its scientific utilization will be performed in cooperation with the NASA Ames Research Center.

The SpaceDRUMS payload will investigate advanced combustion synthesis of materials using a unique acoustic sample positioning system. SpaceDRUMS provides a containerless environment in which to conduct sample processing. SpaceDRUMS is developed, managed and operated by Guigne International of Canada.

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Increased Science Diaglogue Aboard ISS

By David Bauman

A marked difference between ISS missions and earlier Spacelab/ SpaceHab missions has been the level of one-on-one interaction between ISS crews and Principal Investigators (PIs). This difference is most notable in preflight training and during on-orbit operations.

With the demands of training a crew of two or three to operate and maintain a vehicle such as the ISS, the time allotted to Payloads is an order of magnitude less than when NASA was flying dedicated Space Shuttle science missions. For ISS missions, the PI-crew interaction has largely been replaced with a reliance on procedures, software and label commonality along with onboard training. PIs have been further separated from their science operations by restrictions on how much on-orbit, real-time interaction they are allowed to have with the crews.

With only two crewmembers to support all Station operations, some innovative ideas have had to be used to continue performing science on the ISS. Further, with limited upmass, PIs have had to devise creative ways in which to stretch existing supplies on the ISS to produce meaningful science. With the lack of preflight training on these activities, it has become necessary for more direct PI-to-crew interactions to translate the PIs' hypotheses and protocols into science operations.

The ISS Program Scientist, Dr. Don Thomas, is championing this new ISS mode of operations. Besides facilitating direct PI-to-crew interactions, Dr. Thomas has also started conducting periodic conferences with the onboard ISS Science Officer. These conferences are used to get a direct status on science operations and discuss any impediments the crewmembers might be facing in accomplishing their science missions.

The crews have also realized the importance and benefit of direct contact with the PIs. During Increments 8 and 9, the on-orbit crewmembers volunteered their own free time and requested to conduct some of these conferences during their Saturday Science sessions. This has been a tremendous benefit to Payloads as it provides extra time for science, plus the crewmember has a chance to discuss some of the observations from previous runs and make any last-minute adjustments to upcoming experiments—a paradigm closer to how science is conducted on Earth than we have seen to date on the ISS.

> *"...excitement shared by PIs and crewmembers participating in interactive science aboard the ISS can only serve to benefit the ISS Program..."*

On Increment 8, Mike Foale conducted 15 conferences with PIs and the ISS Program Scientist—few of these had been part of pre-Increment planning. Twenty-eight percent (seven of 25) of the U.S.-sponsored payloads aboard Increment 8 used this tool. Mike Fincke is continuing this tradition into Increment 9 and will probably surpass 20 conferences before the end of the increment. To date, Fincke has conferenced with 50 percent (10 of 20) of PIs involved in his increment! Both the crews and the PIs who have participated in these have raved about the benefits each side has realized.

Crewmembers are at liberty to request these conferences or they may also request that PIs provide ground support during their payload operations. If a Payload Developer or PI thinks there is a compelling reason to directly interface with the crew during operations, they should work with their Research Integration Office points of contact to see about the possibility of setting this up.

The time for these crew conferences is counted directly against the crew time resource allotted to Payloads. For the most part, the PI conferences are also not part of the pre-Increment timeline planning. So, the benefits to the individual PI and investigation need to be carefully weighed against the overall cost to Payloads.

With the minimal time available for crew training preflight and with the iterative nature of some investigations, payload developers should consider the option to directly interact with crewmembers during operations. The standard tools the Payloads Office has in place (e.g., Onboard Training, Daily Summaries, etc.) should, of course, be relied upon as much as possible. But, as demonstrated by recent Increments, the excitement shared by PIs and crewmembers participating in interactive science aboard the ISS can only serve to benefit the ISS Program and the science being conducted there.

Increment

(continued from Page 10)

The Increment 11 prime crew is comprised of Sergei Krikalev (CDR) , John Phillips (FE-1) and Sergie Volkov (FE-2). The backup crew is Mikhail Tyurin (CDR), Dan Tani (FE-1) and Roman Romaneko (EF-2). Crew Training for Increment 11 commenced in February of 2004 – a little later than usual due to changes in crew assignments as well as the manifest. All nominal training is scheduled to be completed in November 2004, and proficiency training is scheduled to be complete by February 2005. The training plan is based on the CDR and FE-1 going up on 10S and FE-2 joining them when STS-121 launches a month later. The preliminary crew time allotment for Increment 11 is estimated to be 363.2 hours, 139.2 hours of which will be new ULF 1.1 payloads.

Editor's Page

Mick Culp, Editor
ISS Payloads News
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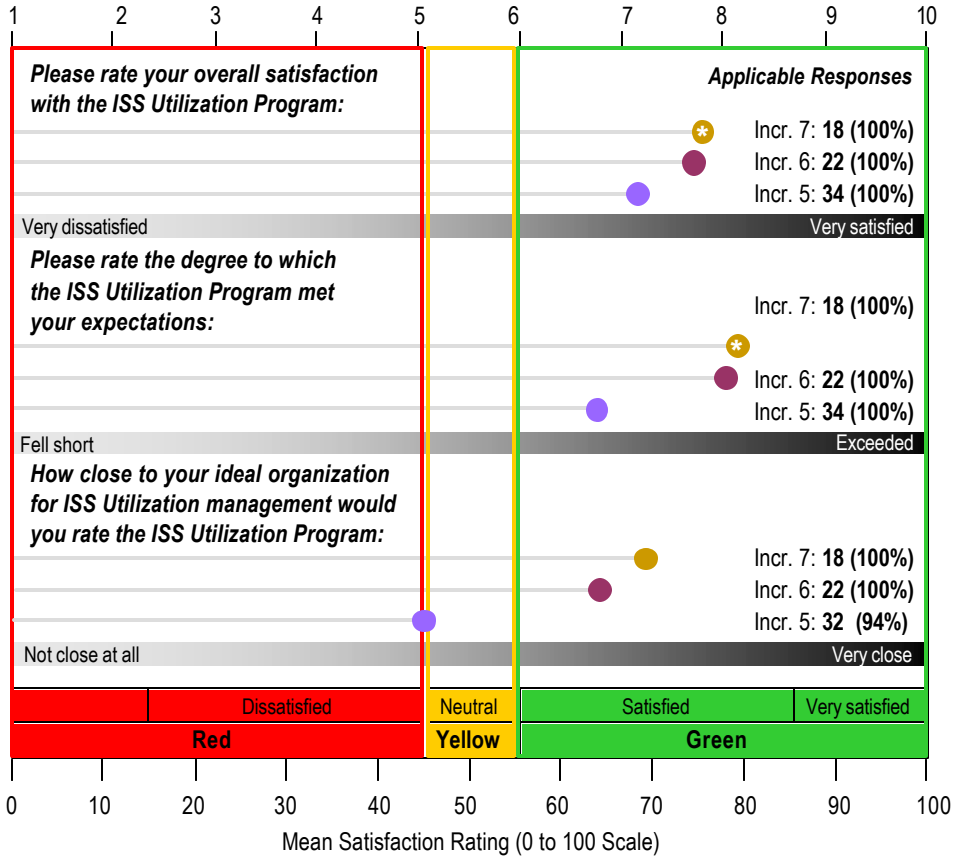
Despite budget cuts and workforce downsizing, the ISS Payloads Office is maintaining its focus on customer satisfaction and continued process improvement. The chart below shows the top-level results of the Customer Surveys through Increment 7. Though the survey delves in some detail into a Principal Investigator's or Payload Developer's experiences with ISS integration and operations processes, the chart shows just the responses to the questions used by the developers of the American Customer Satisfaction Index (ACSI) to rate unlike industrial and government entities by their ability to satisfy the needs of their customers.

The three questions are listed on the left with the aggragate responses from customers from Increments 5, 6 and 7. The results show a sizeable improvement from Increment 5 to 6 and a smaller but positive change from Increment 6 to 7. Statistical assessment tells us that only the change in the third question is significant in the latest comparison.

The right-hand column is a list of ACSI rankings for varied industry and government organizations. Added to these scores are the Organizational Satisfaction Index (OSI) scores for ISS Utilization for Increments 5, 6 and 7. The OSI is a mathmatical approximation to the complex ASCI. Before you ask, we are wrestling with the cost benefit of having an actual ASCI developed. However, an accurate comparison with Wal-Mart seems far less important than knowing whether we are improving against our own past performance.

Increment 8 interviews are nearly complete, so we'll have an update next time. Thanks to all who have taken the time to participate in these surveys.



* *No statistically significant change from previous Increment.*

INDUSTRY RANKINGS	*Score**
Amazon.com	84
ISS INCREMENT 7 OSI	77
Retail Industry *(aggregate)*	75
Wal-Mart	75
ISS INCREMENT 6 OSI	73
Federal Government *(aggregate)*	70
NASA/Glenn Research Ctr	67
Airlines *(aggregate)*	66
McDonald's	64
Federal Aviation Agency *(commercial pilots)*	64
Internal Revenue Service *(tax filers)*	63
ISS INCREMENT 5 OSI	60
National Science Foundation *(grantees & applicants)*	58

**Source: American Customer Satisfaction Index (ACSI) 2004*

The *American Customer Satisfaction Index (ACSI)* is a long-standing organizational cross -comparison index for customer satisfaction. We use an OSI calculated from methods that approximate ACSI.

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are lit properly, we can see much, much smaller scale structures than my expectation.

Are you pleased with the overall experience?

In April 2003, we were first given information about the experiment and we were getting data less than a year later from the Space Station; which, from what I'm told, is ridiculously fast. I would have a hard time imagining things could be better. Now all we want is more data.